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(12) UK Patent Application (19) GB (11) 2 153 082 A

(43) Application published 14 Aug 1985

(21) Application No 8500079

(22) Date of filing 3 Jan 1985

(30) Priority data
(31) 8400037 (32) 4 Jan 1984 (33) SE
8405679 13 Nov 1984

(51) INT CL⁴
G01F 23/36

(52) Domestic classification
G1N 1A3B 1D8 7G ACK
U1S 1807 G1N

(56) Documents cited
GB 0673624

(58) Field of search
G1N

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(54) Liquid level gauge

(57) A liquid level gauge comprises two parallel rods (16,17), having resistance wires (18,19) wound around them. The rods are surrounded by a float (6,7) with a contact (1 to 3) connecting the two resistance wires (18,19) to each other and arranged between the two wires (18,19). The float is displaceable along the resistance wires (18,19) such that an indication of the liquid level is provided. The liquid level gauge is particularly suitable for indicating the quantity of liquid in a vehicle fuel tank.

FIG. 7

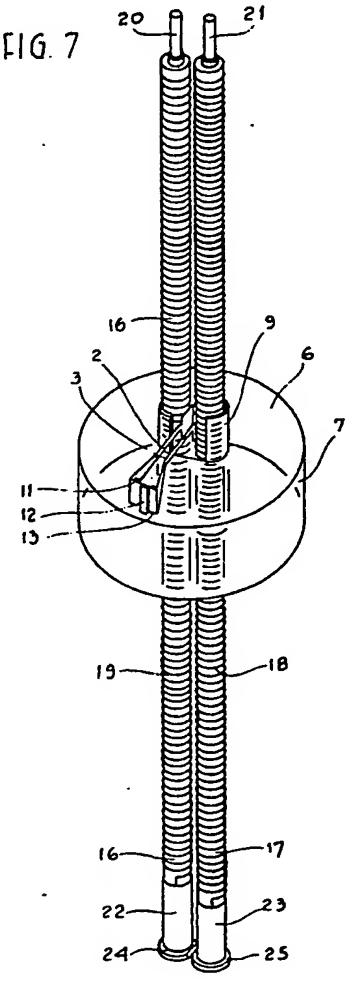

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FIG. 1

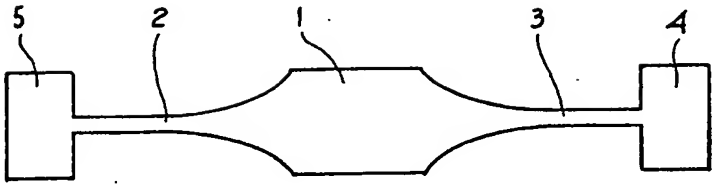

FIG. 2

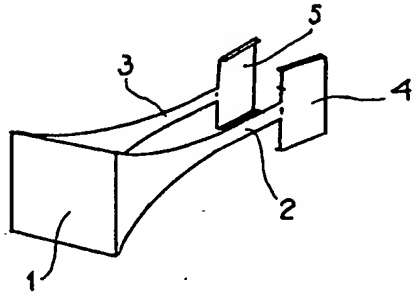

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FIG. 3

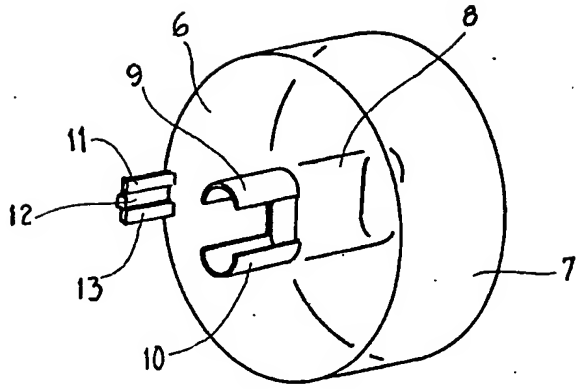

FIG. 4

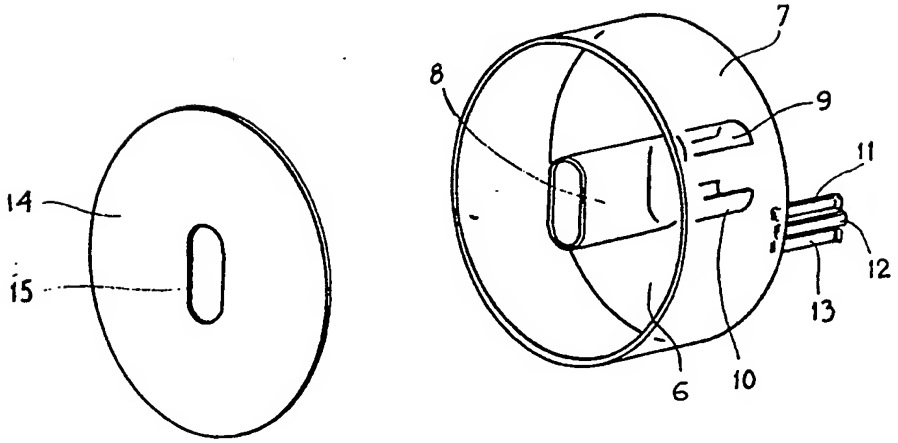

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FIG. 5

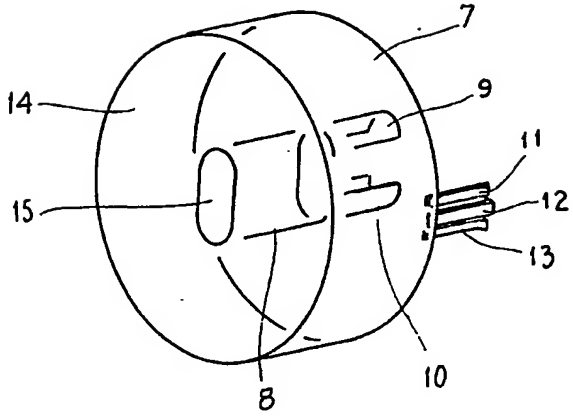

FIG. 6

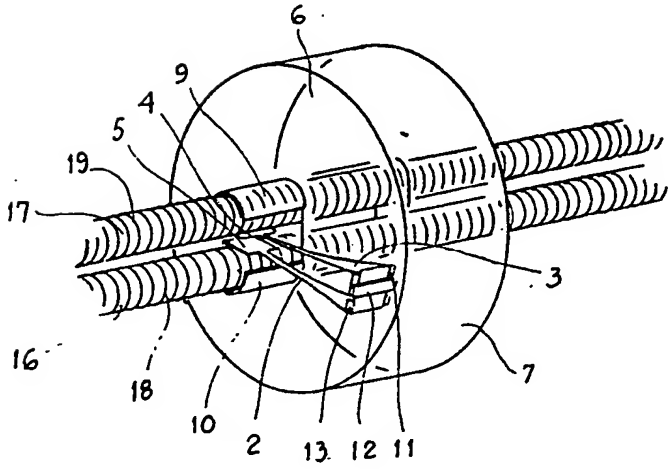

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FIG. 7

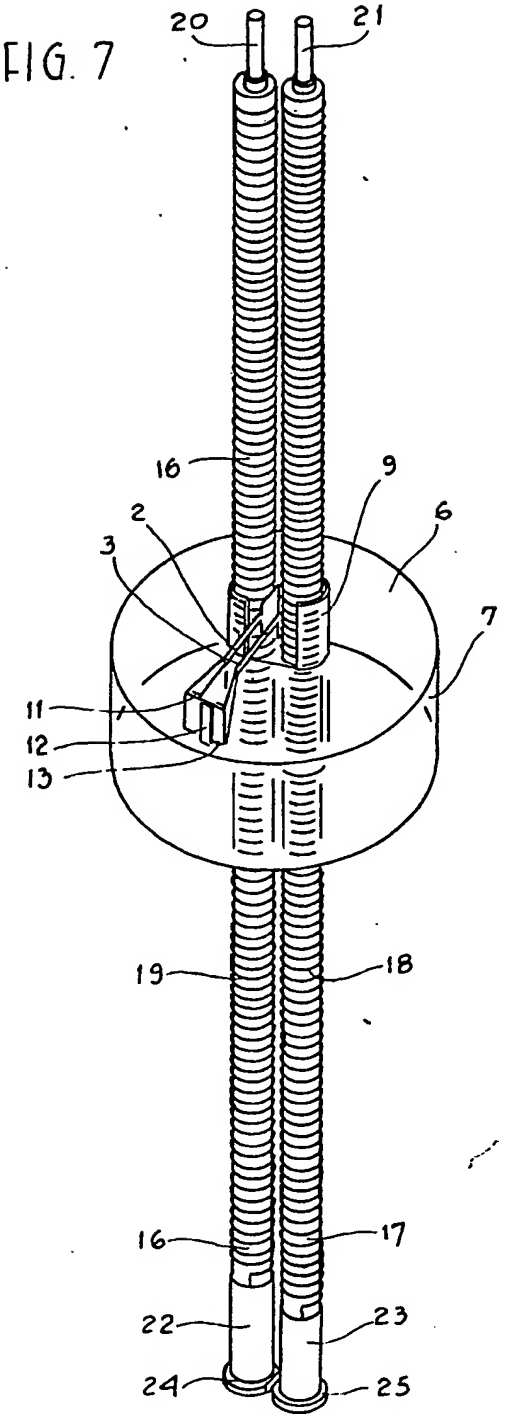

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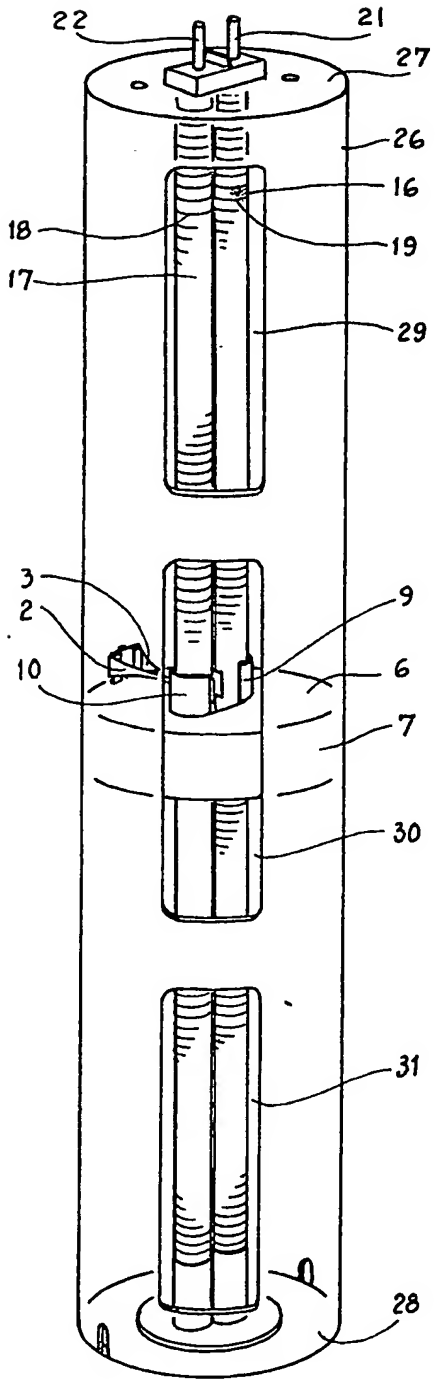
FIG. 8



SPECIFICATION

Liquid level gauge

The present invention relates to a liquid gauge, for example, to a level indicator for use in the fuel tanks of transport means, such as cars, ships, aircraft, etc.

It is already known to provide level indicators which use resistance wires and floats with electrical contacts abutting the resistance wires, the floating moving along the resistance wires depending upon the level of the liquid. However, the known techniques has not provided sufficiently reliable and simple constructions.

It is an object of the present invention to provide a liquid gauge which is simple in design.

According to the present invention there is provided a liquid gauge comprising two elongate members substantially parallel to each other and spaced from each other, said members being attached to retainers at each end, and having resistance wires wound around them between their ends and being surrounded by a float having two tailing contacts in electrical contact with each other, each trailing contact abutting against one of the two wound resistance wires as well as being located between the two elongate members, said float being displaceable relative to the resistance wires such that the position of the float relative thereto provides an indication of the liquid level.

Each elongate member may be provided at its end with a thin metal contact with which one end of the resistance wire is in electrical contact. The end of the resistance wire may either be the one nearest the thin metal contact or that furthest away.

One or both ends of the elongate members may be provided with surfaces of electrically conducting materials, the surfaces being in electrical contact with the nearest ends of the resistance wires or being entirely electrically insulated from the whole liquid gauge.

The trailing contacts abutting the resistance wires should preferably cover at least three turns of each resistance wire.

In a preferred embodiment, each trailing contact is provided with an abutting portion substantially parallel to the corresponding elongate member so as to abut with spring pressure, and is preferably also pivotable about an axis perpendicular to the axis of the elongate member.

The two trailing contacts and the portion connecting them are preferably produced by punching them from a sheet of resilient metallic material. The trailing contacts are located at the ends of the punched-out piece of metal and an intermediate portion is intended for attachment to the float. Between the intermediate portion and each trailing contact, the metal is such that each trailing contact can be subjected to a turning movement about the longitudinal axis of the metal part. The metal part is bent so that when the intermediate portion is secured to the float and the trailing contacts abut the elongate members there will be spring contact, i.e. irrespective of any lateral movement of the float each trailing contact will always be in contact with the elongate member.

Instead of being surrounded by resistance wire, each elongate member may be coated with a layer of an electrically conducting material.

It is advantageous if each elongate member preferably consisting of a ceramic or plastic material which is not electrically conducting, is provided with a metal body running through it. This may be strip or rod-shaped, but rod-shaped is preferable.

The metal through-body preferably protrudes from at least at one end of the elongate member, and the protruding portion can be used to secure the said member. The metal through-body may also be used as a conductor for electric current. One end of a resistance wire or a layer may, for instance, be electrically connected to the adjacent protruding end of the metal through-body.

The aperture through the float should be designed to prevent the float from rotating about the two cylindrical bodies.

The float should be dimensioned to prevent stick-slip motion.

At least at one end the float may be provided externally with one or more guides to ensure minimum pivoting about an axis perpendicular to the elongate members.

The float preferably consists of two end sections with a peripheral wall between them, and is preferably cylindrical. The float may also be provided internally with guides to assist its movement along the elongate members. Buoyancy material may also be provided in the space inside the float. The outer surface of the float ends are preferably such that when in contact with another surface, the contact area is limited to prevent retention.

The two elongate members and the float are preferably arranged in a casing consisting of two end sections and a peripheral wall. The casing may consist of two parts which are joined together, each part including one end section.

The inner surface of at least one end section is such that upon contact with the float, the contact area is limited.

An embodiment of the invention will hereinafter be described, by way of example, with reference to the accompanying drawings, in which:–

Figure 1 shows a blank for an electrical contact means,

Figure 2 shows the contact means of Fig. 1 in its final shape,

Figure 3 shows the main part of a float,
Figure 4 shows the float of Fig. 3 with a lid,
Figure 5 shows a complet float,
Figure 6 shows the float mounted on two cylindrical members provided with resistance wires,
Figure 7 shows the cylindrical members in their assembled state, and
Figure 8 shows the apparatus of Fig. 7 enclosed in a casing.

Fig. 1 shows a piece of metal sheet punched out of a resilient material. The metal sheet has an intermediate portion 1 and two connecting portions 2 and 3 joining the intermediate portion to two contact sheets 4 and 5. The punched metal blank is bent as shown in Fig. 2. Due to the resilience of the bent section the trailing contacts 4 and 5 always try to spring apart, i.e. they have a spring tension which operates transversely outwards. The unit shown in Fig. 2 is designed to be attached to a float, the construction of which is shown in Figs. 3 and 4. The float is preferably manufactured in plastic and may be transparent. It consists of an upper end section 6 joined to a peripheral wall 7. An oval guide piece 8 protrudes from the upper end part 6, is tubular and has an opening in the end section 6. Two guides 9 and 10 extend from this latter opening and have the same peripheral shape as the tubular part 8. At the periphery of the end section 6 are three pins 11, 12 and 13, each pin having a flange at the top. The flanges on parts 11 and 13 are directed transversely outwards whereas the flange on part 12 is directed inwards. The float is open at its other end and is provided with a lid 14 having an aperture 15 to fit the periphery of the tubular part 8. An assembled float is shown in Fig. 5. A unit of the kind shown in Fig. 2 is fitted to the float, the intermediate portion 1 being placed between the pins 11, 12 and 13 with pins 11 and 13 located on one side of the intermediate part 1 and pin 12 located on the other side. The unit shown in Fig. 2 thus has fixed orientation on the float. The float is then passed over two elongate, cylindrical members 16 and 17 around which resistance wires 18 and 19 have been wound. The float is placed around the resistance wires so that trailing contacts 4 and 5 are located between the two cylindrical members 16 and 17. This is achieved since the cylindrical members are substantially parallel and spaced from each other. The cylindrical members 16 and 17 and the float 6, 7, 15 thus form a liquid gauge as shown in Fig. 7. The lower ends of the two cylindrical members are connected to metallic sheaths 22 and 23, these sheaths being provided with a limiting flange to enable orientation of the cylindrical members when permanently placed. The resistance wires 18 and 19 may be joined by their upper ends to through-rods 20 and 21 or by their lower ends to the metallic sheaths 22 and 23. The conducting rods 20 and 21 are then used as electrical conductors to transmit current from the lower ends of the cylindrical members. The conducting through-rods 20 and 21 function not only as electric conductors but also as support means for the cylindrical members 16 and 17. The ends of the rods 20 and 21 may also be used as attachment means. Instead of using electric resistance wires wound around the cylindrical members it is also possible to coat them with a suitable electrically conducting layer, such as a layer of metal.

The outwardly directed spring force of the trailing contact 4 and 5 guarantees that they will always be in contact with the surfaces of the cylindrical members and because of the design of the connecting parts 2 and 3 the contacts 4 and 5 have certain pivotal freedom about axes perpendicular to the two cylindrical members 16 and 17. This pivotal movement might be likened to torsional vibration. Thanks to the tubular part 8 and extensions 9 and 10 which provide guiding units on the float, the float is prevented from pivoting about an axis perpendicular to the two cylindrical members, and stick-slip motion is also prevented. The liquid gauge shown in Fig. 7 may be built into a casing 26 with end walls 27 and 28. The ends of the cylindrical members are secured to said end walls. The cylindrical casing is provided with apertures 29, 30 and 31 for the passage of liquid. Instead of being smooth, the inner surfaces of the end walls 27 and 28 are rough, e.g. provided with raised portions to prevent adhesion of the float. Alternatively, the external surfaces of the float can be roughened to achieve the same effect.

Depending on how the resistance wires 18 and 19 are connected to the through-rods 21 and 22, the float can indicate zero position either in its upper or lower position.

The design of the trailing contacts in thin, resilient material and their covering at least three turns of the resistance wires ensures an extremely reliable indication of the liquid level as well as causing very low friction between the float and the cylindrical members and resistance wires.

CLAIMS

1. A liquid gauge comprising two elongate members substantially parallel to each other and spaced from each other, said members being attached to retainers at each end, and having resistance wires wound around them between their ends and being surrounded by a float having two trailing contacts in electrical contact with each other, each trailing contact abutting against one of the two wound resistance wires as well as being located between the two elongate members, said float being displaceable relative to the resistance wires

such that the position of the float relative thereto provides an indication of the liquid level.

2. A liquid gauge as claimed in Claim 1, wherein each trailing contact covers at least three turns of the resistance wires on each elongate member.

3. A liquid gauge as claimed in Claim 1 or 2, wherein each of the two elongate members is provided at least at one end with cylindrical sheath surfaces of electrically conducting material, each sheath surface being in electrical contact with the adjacent end of the resistance wire wound around the elongate member.

4. A liquid gauge as claimed in Claim 3, wherein the cylindrical sheath surfaces are electrically completely insulated from other parts of the gauge and wherein said cylindrical sheath surfaces cooperate with further trailing contacts which are electrically isolated from said first trailing contacts, said further trailing contacts and said cylindrical sheath surfaces forming an electric switch.

5. A liquid gauge as claimed in any preceding claim, wherein the resistance wires are replaced by a layer conducting electric current, such as a metallic layer.

6. A liquid gauge as claimed in any preceding claim, wherein each elongate member is provided centrally with a metal through-rod running through it, for use as conductor for the electric current and also as attachment means.

7. A liquid gauge as claimed in Claim 6, wherein the resistance wire running along an elongate member is in electrical connection with the adjacent end of the through-rod.

8. A liquid gauge as claimed in any preceding claim, wherein each trailing contact has a contact section lying substantially parallel to the corresponding elongate member in such a way as to be in contact by means of spring pressure and can also be turned about an axis perpendicular to the axis of the elongate member.

9. A liquid gauge as claimed in any preceding claim, wherein two trailing contacts constitute the ends of a piece of resilient metal sheet.

10. A liquid gauge as claimed in Claim 9, wherein between one trailing contact and its middle section the metal sheet is shaped to enable rotation about the longitudinal axis of the metal sheet.

11. A liquid gauge as claimed in any preceding claim, wherein the float consists of two end discs, and a peripheral wall arranged therebetween, and has a central aperture of such a length as to avoid stick-slip motion.

12. A liquid gauge as claimed in Claim 11, wherein the float is provided externally at least at one end with one or more guides.

13. A liquid gauge as claimed in Claim 11, wherein the outer surface of at least one end disc of the float is such that when coming into contact with a flat surface only a limit area will be in contact.

14. A liquid guage as claimed in any preceding claim, wherein the two elongate members and the float are arranged in a casing comprising a peripheral wall and two end walls.

15. A liquid gauge as claimed in Claim 14, wherein the casing consists of two halves, each having one end wall.

16. A liquid gauge as claimed in any preceding claim, wherein the central aperture of the float has a shape which prevents rotation of the float.

17. A liquid gauge as claimed in Claim 14, wherein at least one end wall of the casing is shaped internally so that only a limited portion will be in contact with the float.

18. A liquid gauge substantially as hereinbefore described with reference to the accompanying drawings.

Printed in the United Kingdom for
Her Majesty's Stationery Office, Dd 8818935, 1985, 4235.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.